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Intermountain Forest and Range Experiment Station
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A GUIDELINE FOR THE NORTHERN ROCKY MOUNTAINS FOR DETERMINING THE POTENTIAL OF WINDFELLED TIMBER IN DEVELOPING INSECT POPULATIONS

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WIND TYPES RESPONSIBLE FOR BLOWDOWNS

Coniferous forests in the northern Rocky Mountain region have suffered considerable damage during the past several years as the result of the uprooting of trees by violent winds. The Missoula Weather Bureau Station states that some of these winds occur in the summer months from violent downdrafts generated from falling precipitation under cumulo-nimbus (thunderhead) clouds. Striking the ground, these downdrafts fan out sideways, principally in the direction of the prevailing wind aloft.

During the winter months strong latitudinal winds occasionally occur in conjunction with general storm movements. These winds sometimes reach velocities of from 75 to 100 or more miles per hour at elevations of 5,000 feet above sea level. A second type of forceful winter wind occurs as high velocity wind fields along the frontal surfaces of cold air masses moving cross-country.

Each of these three types of wind is capable of uprooting trees; the character and amount of blowdown depending upon such things as soil moisture, soil structure, exposure, tree species, stand density, and others.

At the present time there is believed to be a large volume of timber uprooted during the past year by violent winds, especially those which occurred in northeastern Washington, northern Idaho, and western Montana on December 22-23, 1955 with velocities as great as 90 m.p.h. The blowdown timber is probably well scattered throughout this area in the form of single trees, small groups of trees, or in large groups which may extend to several acres or more in size.

WINDFELLED TREES BREED INSECTS

Windfelled trees of several conifers native to this region remain as attractive breeding places for certain species of tree-killing insects and wood borers for periods of up to two years following their uprooting. The degree of attractiveness is influenced by the freshness and moisture condition of the bole cambium, i.e., the layer of growing tissue between the sapwood and the bark. This in turn is influenced by the exposure of the tree to the sun, the retention or breaking of the limbs, clean breakage of the trunk, and the amount of the attached root system still imbedded in the soil, etc.

Several major forest insect pests are attracted to the windfelled trees which serve as breeding places. Because the breeding environment is so favorable, the populations of these insect species often increase tremendously. When brood development is completed in the windfelled trees, the new adult insects emerge. If additional freshly uprooted trees, recently felled trees, unskidded logs and poles, or fresh logging or land clearing slash, are not immediately available in quantity, the emerging insects may attack and kill nearby living trees. The 1952-56 epidemic of the Engelmann spruce beetle (Dendroctonus engelmanni Hopk.) which caused the killing of over 2 billion board feet of Engelmann spruce in this region started from beetle populations which bred in timber uprooted in the windstorm of November 25, 1949.

The insect producing potential of windfalls is further enhanced because the prostrate trees are often buried under snow during the winter and therefore inaccessible to woodpeckers that avidly feed on the larvae and adults of overwintering bark beetle broods.

INSECTS AND HOSTS MOST FREQUENTLY INVOLVED

The greatest tree killing in the region's forests from insects developing in blowdown trees occurs from population build-ups of the following bark beetles, in the order of decreasing importance:

Beetle species	Host trees
1. Engelmann spruce beetle (Dendroctonus engelmanni Hopk.)	Engelmann spruce
2. Douglas-fir beetle (Dendroctonus pseudotsugae Hopk.)	Douglas-fir
3. Pine engraver beetles (Ips spp.)	Ponderosa pine
4. Western pine beetle (Dendroctonus brevicomis Lec.)	Ponderosa pine
5. Mountain pine beetle (Dendroctonus monticolae Hopk.)	Western white pine

Tree killing epidemic infestations originating in blowdowns are limited in this region almost entirely to forests of the above-named host species. No such infestations of any consequence have occurred in forests of western red cedar, western larch, true firs, western hemlock, lodgepole pine, or other native conifers of lesser commercial importance.

In addition to breeding tree-killing bark beetle populations, blowdown timber of all species is almost always infested by wood boring insects, chiefly roundheaded and flatheaded borers (beetle), ambrosia beetles, or clear-wing moths. Although these insects do not emerge from the blowdown timber to attack living trees, they perforate the sapwood and heartwood of the uprooted trees and thus lower their salvage value for lumber and poles.

There is now a need--and there will be recurring need--to determine the insect potential of current blowdown timber. Timberland owners and all private and government timberland managing agencies can help in this activity by cooperating in the program suggested below.

DETERMINING THE INSECT POTENTIAL OF CURRENT BLOWDOWNS

This can be done any time, snow conditions permitting, from October 1, 1956 until May 1, 1957, or similar dates any other year. The determination needed now can be based upon the presence or absence of bark beetle broods in the cambium layer or inner bark of windfelled trees uprooted any time during the calendar years 1955 or 1956. The following procedure can be used:

(1) Locate Engelmann spruce, Douglas-fir, ponderosa pine, or western white pine trees felled by wind in 1955 or 1956. They may be scattered throughout the forest singly or in small or large groups, most frequently on or immediately below ridge tops or in canyon bottoms.

(2) Select representative windfelled trees of the above species for insect brood sampling, being careful to include sample trees uprooted in shade, partial or full sunlight, and from the top and bottom layers of trees of badly jackstrawed mass blowdown spots.

(3) First, observe the presence of small piles of fine yellowish or reddish boring dust on the outer bark surface, usually in the bark crevices. With a $2\frac{1}{2}$- or $3\frac{1}{2}$-pound double-bit or small pole axe, raise $\frac{1}{2}$-foot square sections of bark on the shady side of the trunk, preferably from the sides, at the base, mid-point and top of the bole. Keep the bark section intact if possible, carefully turn the inner surface face up to avoid spilling any insect brood which may be present on the inner surface, and observe the presence or absence of bark beetle attacks, egg galleries, eggs, larval mines, larvae, pupae, or adult beetles.

(4) If possible, identify the brood or egg gallery pattern present from the attached key.

(5) Record the observations and information asked for on attached field form as completely as possible.

(6) Mail completed field forms to:

Missoula Forest Insect Laboratory
Intermountain Forest and Range
Experiment Station
U. S. Forest Service
Federal Building
Missoula, Montana 1/

EVALUATION OF BLOWDOWN INSECT DATA

Blowdown insect data received by the Laboratory will be analyzed to determine where bark beetle broods are developing in blowdown timber and if such brood development is of such a magnitude as to constitute a source of epidemic infestation in nearby standing timber. Findings will be summarized and prevention of control techniques will be made available to interested timberland owners or managers where conditions warrant.

YOUR COOPERATION IN THIS SURVEY OF THE INSECT POTENTIAL IN CURRENT BLOWDOWN AREAS WILL HELP FORECAST DAMAGING BARK BEETLE OUTBREAKS AND FACILITATE THEIR PREVENTION OR RAPID CONTROL.

1/ National forest personnel send forms through Regional Office, Division of Timber Management.

KEY TO RECOGNITION OF BARK BEETLES IN BLOWDOWN TIMBER

A. On outer bark surface, top and sides of trunks of prostrate trees.

1. Small piles of fine-grained yellowish or reddish boring dust in bark crevices (often absent in winter)

a. Yellowish dust on sides of trunk or on ground or plant foliage under the trunk, also on tops of shaded trunks,

in Engelmann spruce	ENGELMANN SPRUCE BEETLE
in ponderosa pine	(WESTERN PINE BEETLE and (MOUNTAIN PINE BEETLE
in western white pine	MOUNT IN PINE BEETLE

b. Yellowish dust on tops of trunks, in Engelmann spruce, ponderosa pine and western white pines — PINE ENGRAVER BEETLES

c. Reddish dust on top and sides of trunks,

in Douglas-fir	DOUGLAS-FIR BEETLE
in ponderosa pine	PINE ENGRAVER BEETLE

B. On inner bark surfaces.

1. Winding, irregular egg galleries, with or without small, pearly-white eggs in niches on sides, galleries about 1/16-inch wide and solidly packed with reddish boring dust

a. In ponderosa pine — WESTERN PINE BEETLE

2. Egg galleries straight, parallel to grain of sapwood, 3/16-inch wide, solidly packed with reddish boring dust, with or without eggs in niches on sides

a. Up to 12 inches average maximum length, in Engelmann spruce, partially free of boring dust — ENGELMANN SPRUCE BEETLE

b. Up to 36 inches average maximum length,

in Douglas-fir	DOUGLAS-FIR BEETLE
in western white pine	MOUNTAIN PINE BEETLE
in ponderosa pine	MOUNTAIN PINE BEETLE

3. Three to five egg galleries radiating from a central chamber but soon straightening out parallel to grain of sapwood, 1/16- to 1/8-inch in width, free of boring dust

a. In Engelmann spruce, ponderosa pine, or western white pine — PINE ENGRAVER BEETLE

C. Location of beetle broods.

1. Parent adult beetles (in egg galleries), eggs, larvae, pupae, and new adult beetles visible in galleries, tunnels, or cells on inner bark surface of trunk

a. in Douglas-fir (brood sometimes within inner bark)	DOUGLAS-FIR BEETLE
b. in western white pine	MOUNTAIN PINE BEETLE
c. in ponderosa pine	MOUNTAIN PINE BEETLE
d. in Engelmann spruce, ponderosa pine, and western white pine	PINE ENGRAVER BEETLES

2. Parent adult beetles, eggs, and larvae visible on inner bark surface; pupae and new adult beetles frequently within inner bark

a. in Engelmann spruce	ENGELMANN SPRUCE BEETLE

3. Parent adult beetles and eggs visible on inner bark surface; larvae, pupae, and new adult beetles within inner bark

a. in ponderosa pine	WESTERN PINE BEETLE

D. Description of bark beetles,

1. Adult beetles, 3/16- to 1/4-inch long, brown or black, cylindrical in shape

a. Rear end smoothly rounded,	DENDROCTONUS spp.
b. Rear end with slanting declivity with toothed margins	IPS spp.

2. Eggs, oval in shape, pearly, white, 1/64 X 1/32 inches in size — DENDROCTONUS and IPS spp.

3. Larvae, full-grown 1/16- to 1/4-inch long, legless, cylindrical, C-shaped, fleshy, white but with hard brown head capsule — DENDROCTONUS and IPS spp.

4. Pupae, soft, fleshy, white, same size and with some of the characteristics of adult beetles — DENDROCTONUS and IPS spp.

E. Evidence of beetle emergence (broods fully developed and trees abandoned by emerging new adult beetles)

1. Circular, clean-cut, holes on outer bark surface without pitch tubes or boring dust

a. 1/16-inch in diameter, in ponderosa pine — WESTERN PINE BEETLE, PINE ENGRAVER BEETLES

b. 1/8-inch in diameter
in ponderosa pine — MOUNTAIN PINE BEETLE, PINE ENGRAVER BEETLES

in Engelmann spruce — ENGELMANN SPRUCE BEETLE
in Douglas-fir — DOUGLAS-FIR BEETLE
in western white pine — MOUNTAIN PINE BEETLE

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Reporting Form

BARK BEETLE DEVELOPMENT IN CURRENT WINDFELLED TIMBER

LOCATION OF OBSERVATION _____

OBSERVER _____ TITLE _____ DATE _____

EMPLOYER _____

EMPLOYER'S MAIL ADDRESS _____

BLOWDOWN DATA: Year of occurrence ____; Area ____ acres; Forest type _____; Tree spp. uprooted _____; Uprooted trees sawlog size _____; Pole size _____; scattered singly _____, in small groups _____, in large groups _____.

Uprooted trees sampled

Tree no.	Tree sp.	Year up-rooted	D.B.H. (in.)	Not infested (check)	Infested by bark beetles					
					Beetle sp. 1/	Brood present 2/	Part of bole infested 3/	Bole bark thickness (in.)		
								B	M	T

1/ SYMBOLS: ESB, Engelmann spruce beetle; DFB, Douglas-fir beetle; WPB, western pine beetle; MPB, mountain pine beetle; IPS, pine engraver beetles.
2/ SYMBOLS: PA, parent adult beetles; E, eggs; L, larvae; P, pupae, NA, new adult beetles; AB, abandoned, NA beetles emerged.
3/ SYMBOLS: B, basal; M, mid-bole; T, top.